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Direct Photon Simulations with POWHEG BOX

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Direct photons provide particular insight into nuclear collisions. Since they give immediate access to the energy scale of a hard scattering, direct photons allow further constraints of (nuclear) parton distribution functions, especially on the poorly known distribution of initial state gluons. Direct photons have, moreover, the potential to yield unambiguous information on hot nuclear matter; in contrast to hard partonic probes they are not strongly affected by the medium.

In the last two decades, fixed order calculations of direct photons beyond leading order and resummation methods beyond leading log accuracy came to fruition. Yet, a parton shower Monte Carlo approach beyond Leading Order has been neglected so far, which is a pressing issue with respect to the prevalence of shower Monte Carlo generators in the HEP community. Considering that photon fragmentation functions for fixed-order calculations received no major updates in the last two decades, the role of the shower Monte Carlo approach becomes even more significant.

We present the POWHEG BOX implementation of the dominant direct photon production processes $qg \to q\gamma$ and $q\overline{q} \to g\gamma$ at Next-to-Leading Order, interfaced with the PYTHIA8 parton shower. We aim for a robust description of direct photons and investigate therefore various simulation parameters of both the hard scattering kernel and the shower Monte Carlo. We present comparisons to direct/isolated photon measurements from ATLAS, CMS and ALICE and evaluate the improvement with respect to the PYTHIA8 standalone description. In preparation of the differential direct photons measurements to come, we will in addition provide a study about gamma-hadron and gamma-jet correlations including isolation criteria.

Preferred Track

Electromagnetic Probes

Collaboration

Not applicable

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